MICRO - MAINFRAME SOFTWARE PLANNING

INPUT

About INPUT

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

The company carries out continuous and in-depth research. Working closely with clients on important issues, INPUT's staff members analyze and interpret the research data, then develop recommendations and innovative ideas to meet clients' needs.

Clients receive reports, presentations, access to data on which analyses are based, and continuous consulting.

Many of INPUT's professional staff members have nearly 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed in 1974, INPUT has become a leading international planning services firm. Clients include over 100 of the world's largest and most technically advanced companies.

Offices

NORTH AMERICA

Headquarters
1943 Landings Drive
Mountain View, CA
94043
(415) 960-3990
Telex 171407

Detroit
220 East Huron
Suite 209
Ann Arbor, MI 48104
(313) 971-0667

New York
Park 80 Plaza West-1
Saddle Brook, NJ 07662
(201) 368-9471
Telex 134630

Washington, D.C.
11820 Parklawn Drive
Suite 201
Rockville, MD 20852
(301) 231-7350

EUROPE

United Kingdom
INPUT, Ltd.
41 Dover Street
London W1X 3RB
England
01-493-9335
Telex 27113

France
La Nacelle
Procedure d'abonnement 1-74
2, rue Campagne Premiere
75014 Paris
France
322.56.46
Telex 220064 X5533

Italy
PGP Sistema SRL
20127 Milano
Via Soperga 36
Italy
Milan 284-2850
Telex 310352

Sweden
Athena Konsult AB
Box 22232
S-104 22 Stockholm
Sweden
08-542025
Telex 17041

ASIA

Japan
ODS Corporation
Shugetsu Building
No. 12-7 Kita Aoyama
3-Chome Minato-ku
Tokyo, 107
Japan
(03) 400-7090
Telex 26487

K.K. Ashisuto
Daini-Suzumaru Bldg., 6th Floor
8-1, Nishi Shimbashi
3-Chome Minato-ku
Tokyo, 105, Japan
(03) 437-0654
Telex 781 26196

Singapore
Cyberware Consultants (PTE) Ltd.
2902 Pangkor
Ardmore Park
Singapore 1025
734-8142

INPUT®
Planning Services For Management

MICRO-MAINFRAME SOFTWARE PLANNING

MICRO-MAINFRAME SOFTWARE PLANNING

ABSTRACT

Over the next decade there will be a move toward the integration of data processing, office systems, and personal computing with the microcomputer as the strategic component of future information systems. To meet the demands of this integration, the software developers are starting to offer linkage products that enable micro-computer end users to select and extract specific data from a variety of host data management systems for direct use in a wide variety of microcomputer applications packages.

Because the micro-mainframe (M-M) market is in its infancy, there is a divergence of functions, features, and prices being offered. For instance, the portion of the M-M software that resides on the mainframe can cost anywhere from $10,000 to $150,000, and the associated microcomputer software can run between $200 and $2,000 per unit.

The report covers the impact of M-M software on the corporate systems development strategy, factors to consider in the development and selection of M-M software, case studies of user organizations that have implemented M-M links, and product profiles.

This report contains 87 pages, including 12 exhibits.

MICRO-MAINFRAME SOFTWARE PLANNING

CONTENTS

INPUT

MICRO-MAINFRAME SOFTWARE PLANNING

EXHIBITS

INPUT

I INTRODUCTION

I INTRODUCTION

A. BACKGROUND

- The data connection of microcomputers to mainframes and minicomputers is an issue that has received much attention from the press over the past year. Vendors have flocked to the marketplace with "micro-mainframe links" and "distributed PC" offerings.

- Attention has focused on end-user demands for electronic access to internal corporate data that frees them from rekeying data that could be electronically transmitted to their personal computers.

- Vendors have answered this call on many different levels, relying mostly on the quick purchasing power of end-user departments by selling terminal emulation packages that end users can install themselves after requesting host computer access from the information systems department (IS).

- To the end users' dismay, the type of data access that they seek requires more than just "logging-on" and pointing with a mouse. Some end users have sought short-term solutions from IS. IS, in turn, has given them file-level downloading and key-to-disk uploading capabilities from their micros.

- INPUT believes micro-mainframe issues could produce data processing discontinuity at least as great as that produced by the introduction of the

©1985 by INPUT. Reproduction Prohibited.

INPUT

System/360. Recent trends in data processing, beginning with the introduction of the minicomputer and climaxing with the success of the IBM PC, are leading to a distributed information environment and away from data centralization.

- <u>Micro-Mainframe: Software Planning</u> is one of a four-part series of reports addressing the planning needs of information systems department executives and managers. This series will identify today's software planning environment and serve as useful planning documents for the next three years.

B.   METHODOLOGY

- The report research was conducted in parallel with that for three other related reports (see related INPUT reports section below). A large project team spent several months researching and analyzing information. The research consisted of:

   -    Client interviews.

      .   INPUT clients were sampled to ascertain areas of special interest and to learn of their experiences, problems, and needs.

   -    Corporate interviews.

      .   One hundred twenty-nine structured interviews were conducted with IS managers at large corporations in March 1985. The questionnaire used is in Appendix A. The size and industry of those interviewed is shown in Appendix B.

      .   In addition, INPUT analysts reviewed 20 companies in depth to obtain more detailed information about their applications

- 2 -

INPUT

experiences, which formed the basis of the case studies in Chapter IV.

- Vendor interviews.

    . Interviews were conducted with technical support and marketing professionals from 20 vendors. A list of the vendors interviewed is given in Appendix C.

- Product and service analysis.

    . INPUT collected and analyzed information on over 50 products and services in the micro-mainframe area.

    . New introductions of software products addressing micro-mainframe needs occur quarterly. Until the industry settles on several core products as standards, INPUT expects new product introductions to continue, with offerings expected from LAN vendors and various software companies.

C.   SCOPE

- This report, produced as part of INPUT's Software Planning Program, is one of a four-part series covering micro-mainframe (M-M) issues from four different perspectives: corporate, end user, telecommunication, and software.

- This report addresses the applications software aspects of micro-mainframe issues. The topics include:

    - M-M product categories, cost considerations, and emerging standards (Chapter III).

INPUT

-   Application development case studies (Chapter IV).

-   Software products and their applications in the micro-mainframe environment (Chapter V).

-   Conclusions and recommendations (Chapter VI).

D.   RELATED INPUT REPORTS

-   Other INPUT reports related to this topic are:

    -   Micro-Mainframe: End-User Experiences (1985) describes various M-M methods and their advantages and limitations, and projects changes in the technology and marketplace.

    -   Micro-Mainframe Corporate Planning (1985) describes the organizational and technological effects of M-M issues within the corporation in light of the growing demand for end-user access to corporate data bases. The impact of M-M products on the current inventory of stand-alone micro and mainframe software is analyzed.

    -   Micro-Mainframe: Connectivity (1985) addresses the telecommunications issues of M-M links.

    -   Micro-Mainframe Market Trends (1985) segments the market, provides projections for terminal emulation and intelligent packages, and analyzes issues, events, and trends in the marketplace.

-   These reports update a similar series published by INPUT in 1984. The 1984 reports are:

INPUT

- End-User Micro-Mainframe Needs (1984) identifies the major technological and planning aspects of end user and vendor micro-mainframe linkage needs and investigates the future directions of end users through five case studies.

- Personal Computer to Mainframe Market Opportunities (1984) addresses and analyzes M-M developments and the impact they will have on the microcomputer industry. Includes discussions of the changing applications environment, market directions and needs, competitive environment, customer requirements for vendor support, market forecasts, and strategic recommendations.

- Micro-Mainframe: Telecommunications (1984) addresses future trends in M-M telecommunications as they relate to the impact of microcomputers on communications planning. Developments in communications are discussed, and strategies for dealing with them in the corporate environment presented.

- Micro-Mainframe Processing Services and Turnkey System Market Opportunities (1984) addresses opportunities and challenges faced by processing services and turnkey systems vendors, analyzing the threats these suppliers face from microcomputers.

- Other relevent studies are:

  - Data Administration: Experiences and Outlook (1984) defines data administration (DA) and identifies the trends and pressures associated with short- and long-term data administration planning, focusing on practical guidelines for determining DA needs and strengthening DA practices.

INPUT

- <u>Destiny of the Information Center</u> (1985) examines the impact of the microcomputer and end-user computing on the future of the Information Center (IC).

- <u>Integrating Voice and Data Communications</u> (1985) analyzes the changing technologies of telecommunications, the benefits and costs of integration, and the evolution of LAN, CBX, and other devices, and also provides guidelines to when data-only networks are most appropriate.

- <u>LAN/CBX Trends: Decision Processes for Users</u> (1984) describes current and future product trends and presents a planning process for managers to ensure successful implementation of a strategy that meets corporate needs.

- <u>LAN/CBX Update</u> (1985) reports current experiences with these data and data/voice communications technologies, and looks at the future of office-oriented communications devices.

- <u>Office Videotex</u> (1985) examines corporate, in-house applications for this user-friendly technology which has thus far failed to make an impact as a new consumer-oriented media.

INPUT

II EXECUTIVE SUMMARY

II   EXECUTIVE SUMMARY

- This executive summary is designed in a presentation format in order to:

  - Help the busy reader quickly review key research findings.

  - Provide an executive presentation and script that facilitates group communications.

- The key points of the entire report are summarized in Exhibits II-1 through II-6. On the left-hand page facing each exhibit is a script explaining the exhibit's contents.

INPUT

A. LINKED MICROS' EXPLOSIVE GROWTH

- In 1984 there were approximately three million microcomputers installed in businesses with revenues exceeding $10 million. Of these three million, only 15% were able to access data stored in host mainframe data bases and files. These figures jumped to four million with 22% linked in 1985. From 1985 to 1987 the average annual growth rate for installed micros is expected to be only 27%, but the average annual growth rate for linked micros is expected to jump to 83%. There will be as many micros linked to mainframes in 1987 as were installed in 1984.

- The current linkage activity concentrates on providing a limited number of end users with the ability to emulate a video display terminal through their microcomputers and download screen images or preestablished files for use with their personal computing software packages.

- Over the next decade there will be a move toward the integration of data processing, office automation, and personal computing, with the micro-computer as the strategic component of the future information systems. To meet the demands of this integration, the software developers are starting to offer linkage products that enable microcomputer end users to select and extract specific data from a variety of host data management systems for direct use in a wide variety of microcomputer applications packages.

- 8 -

INPUT

EXHIBIT II-1

LINKED MICROS' EXPLOSIVE GROWTH

Millions of Units

8

6.5

6

AAGR

4.0   27%   3.6

3.0   46%

2   33%

0.6   0.9   83%

15%   50%   22%

0

1984   1985   1987
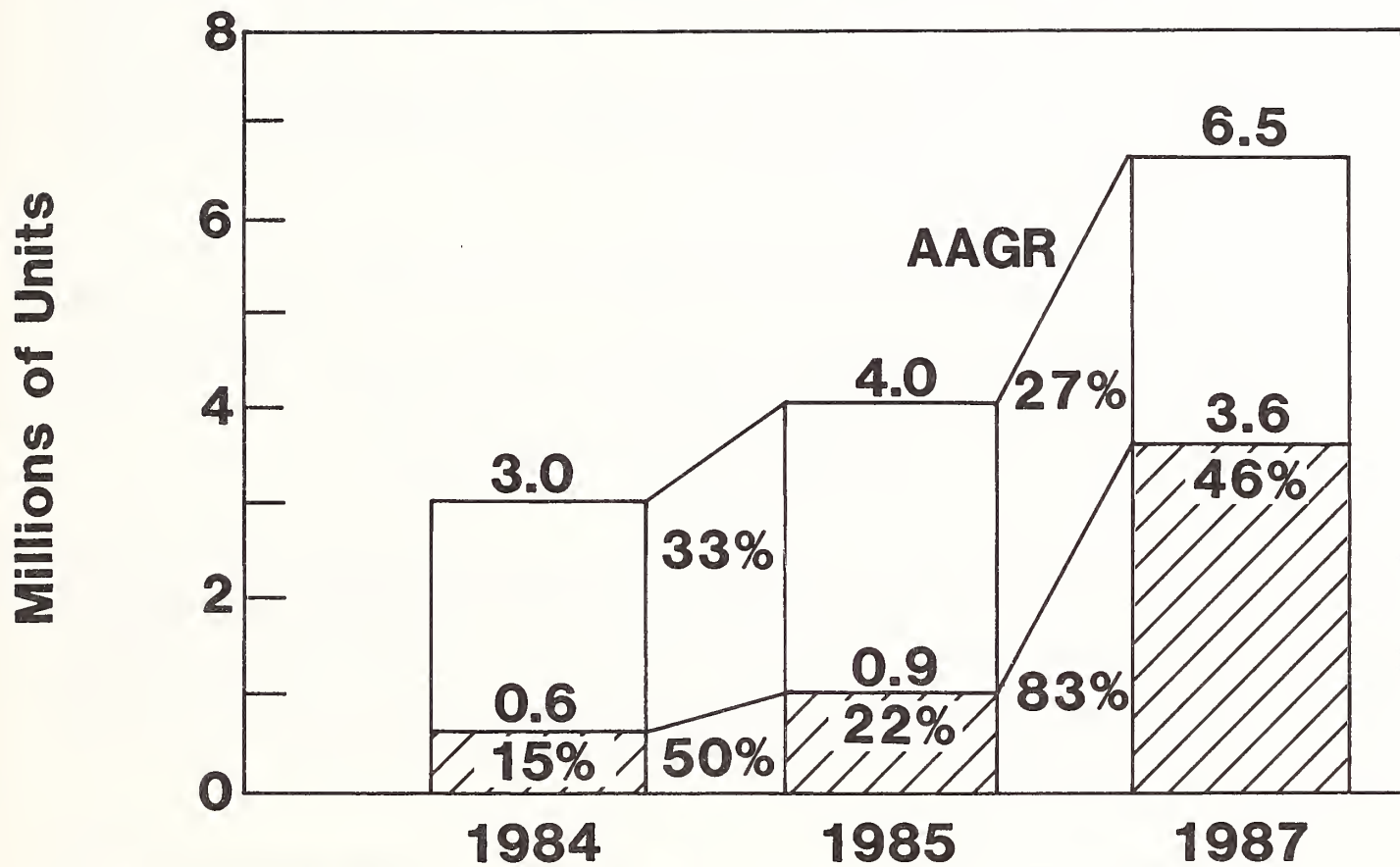
�)/ **Linked Micro-Host, Micro-LAN-Host**

B. MICRO-MAINFRAME MARKET IS UNSETTLED

- The explosive growth of micro-mainframe links has resulted in a deluge of products on the market that are related to the problem of information exchange between micros and mainframes. The major vendors of IBM mainframe software are starting to compete for the linkage business by offering products that are flexible, easy to use, and fit into a variety of information systems environments. There are even a few vendors whose sole business is related to the micro-mainframe link problem. The competition is so fierce that no one vendor can be identified as the pacesetter.

- The likelihood of identifying one linkage product that will satisfy all current and potential micro-mainframe applications is very slim. In fact, it would be difficult to identify the "perfect" linkage software for even a very specific application.

- Because the M-M market is in its infancy, there is divergence of functions, features, and prices being offered. For instance, the portion of the M-M software that resides on the mainframe can cost anywhere from $10,000 to $150,000, and the associated microcomputer software can run between $200 and $2,000 per unit.

- IBM may be setting the standards for information interchange with its SNA products, but it is far from having the most capable micro-mainframe linkage software. Depending on IBM to provide the total solution to the M-M link problem is not recommended.

INPUT

EXHIBIT II-2

INPUT®

MICRO-MAINFRAME MARKET IS UNSETTLED

- **No Leading Vendors**

- **No Total Solution Product**

- **No Standard Product for Specific Application**

- **No Standard Price**

- **Very Limited IBM Products**

INPUT
USMM

C.   M-M PRODUCT SELECTION FACTORS TO CONSIDER

- With the M-M market unsettled and confusing, the best approach to take in evaluating products is to identify the most important features.

- First and foremost, an M-M product should fit into the existing information systems technical architecture, which includes:

  - Operating systems.

  - Teleprocessing monitor software.

  - Mainframe data management systems.

  - Microcomputer file formats.

- The M-M software should assist the end user in the process of selecting specific host-stored data elements with the inclusion of selection parameters and conditions. The actual execution of the extractions of data from the host data bases and/or files should be under the control of IS for capacity management.

- Even though there may be no current requirements to update host-stored data from microcomputers, the ability to upload data should be a selection factor in anticipation of the move towards the integration of data processing, office automation, and personal computing.

- M-M products to be evaluated should take advantage of the existing on-line environment in which security and data integrity concerns are handled. The M-M software should support the data access security procedures and software currently in use at the host data center.

©1985 by INPUT. Reproduction Prohibited.   **INPUT**

EXHIBIT II-3

M-M PRODUCT SELECTION FACTORS TO CONSIDER

- Supports Installed Data Management Systems

- Supports Installed Micro Software Formats

- Gives End Users Control of Data Selection

- Gives IS Control of Host Activity

- Supports Bidirectional Data Interchange

- Uses Mainframe Security System

D.   M-M I.S. RESOURCE REQUIREMENTS

• There are primarily three levels of applications for the micro-mainframe concept:

- Personal computing entails downloading data from the host to the micro for use with popular packages such as Lotus 1-2-3. Most of these links are satisfied with rudimentary file transfer software and are coordinated through the information center or end-user support group. The linkage software could cost less than $10,000 and would not involve, to any extent, IS personnel outside of the end-user support group.

- More companies are looking into the feasibility of distributing some of the information processing functions throughout the organization through the use of departmental processors or file servers. Personal computing and local data processing would then move to the departmental processor. Positioning these processors in the communications network requires coordination from the IS technical support group with assistance from the applications development staff.

- At the highest level of M-M applications is the corporatewide integration of data processing, office automation, and personal computing. This involves a major change in systems architecture and therefore requires the full attention of both the applications development staff and the technical support staff. The micro-mainframe software has to support a diverse environment and could cost over $200,000, depending on the number of microcomputers supported.

INPUT

EXHIBIT II-4

INPUT®

M-M I.S. RESOURCE REQUIREMENTS

M-M Application	Product Cost	IS Commitment		
		End User Support	Application Development	Technical Support
Personal Computing	L	M-H	L	L
Departmental Processing	M-H	L-M	M	M-H
Corporate Integration	H	L	H	H

* Low   Medium   High

INPUT
USMM

E.   BASIC FIXED COST OF M-M APPLICATION

- There are certain fixed costs associated with any linkage between micro-computers and the host mainframe. The total cost varies considerably, depending on the number of microcomputers involved and the functions delivered. To support 50 microcomputer end users in a micro-mainframe environment could cost from less than $1,000 per micro to nearly $5,000 per micro.

- Along with the basic fixed cost of installing a link are the overhead costs, which include:

  -    Mainframe cycles to process M-M requests.

  -    Communications traffic caused by M-M transfers.

  -    Terminal controllers to accommodate added micros.

- Not only do the license fees for the M-M products vary considerably, but the amount of assistance required from IS to make the linkage operational will also fluctuate from one product to the next.

INPUT

EXHIBIT II-5

INPUT®

BASIC FIXED COST OF M-M APPLICATION
(50 USERS)

FACTOR	COST	
	LOW	HIGH
Micro Software	$ 5,000	$25,000
Host Software	10,000	100,000
Protocol Conversion Hardware	25,000	40,000
Customization	500	2,500
Mainframe Disk	2,500	12,500
Total	$43,000	$180,000

INPUT
USMM

F.   MICRO-MAINFRAME: THE INTERIM SOLUTION

- The demand for access to mainframe data from micros is symptomatic of the need for efficiently dissemenating data. This need can not be satisfied by a class of products (e.g., M-M links). It can only be addressed by establishing a corporate information management strategy. M-M applications must be viewed from the corporate perspective and must address corporate benefits, not just end-user benefits.

- IS must work with users to understand their actual information needs, determine the committed resources available for satisfying these needs, and realistically assess the people, hardware, software, and financial resources available before a commitment can be made. The corporate perspective is important. For example, advanced M-M products require a critical mass of users who can share the fixed-cost expense.

- If an organization can only commit limited resources to micro support, it is recommended that M-M application actively be confined to terminal emulation and file transfer products. More advanced organizations may use record transfer products, but mainly as tools in IS-developed distributed applications.

- M-M applications can be a precursor for future corporate benefits. These applications can demonstrate to management the potential benefit of disseminating computer-based information to the right people at the right time in a useful format. They can sell management on the need for an information management strategy and on IS's role as its chief architect.

INPUT

EXHIBIT II-6

INPUT®

M-M: THE INTERIM SOLUTION

- Put M-M Issues in Context

- Identify Actual versus Perceived Needs

- Identify Resource Committment

- Use M-M Applications to Sell Information Management Strategy

INPUT
USMM

III MICRO-TO-MAINFRAME (M-M) ISSUES

III   MICRO-TO-MAINFRAME (M-M) ISSUES

A.   M-M NEEDS ASSESSMENT

1.   THE SIX STAGES OF MICROCOMPUTER USAGE

- The microcomputer entered the corporate scene only a few years ago (circa 1980) and already it has evolved through at least six stages of service levels.

    - The first stage saw microcomputers from Osborne, Tandy, and Apple trickle in to various levels of managers and professional workers through the normal office equipment purchase order procedures. Most of the applications in the early days were related to word processing and simple spreadsheet calculations. This sporadic acquisition of single purpose microcomputers was met by the IS department with indifference.

    - During the second stage the microcomputer software vendors siezed the opportunity to market products with greater functionality and compatibility. This opportunity was created by the demands of microcomputer users for improved functions and the ability to move data readily between those functions. Users were looking for packages that shared common data formats and user interfaces and provided electronic spreadsheets, word processing, data management, and business graphics.

- 21 -

INPUT

- Once IBM became entrenched in the business world with its PCs and IS started providing training and guidance to the microcomputer end users, a new demand was voiced to connect the PC to the mainframe, allowing the PC to act as a dumb video display terminal. So, stage three saw the installation of add-on printed circuit boards and RS-232C serial ports and modems to allow end users local and remote access to the mainframe for data queries from their IBM PCs. This provided only a view of the data, with no downloading or uploading capabilities.

- It was only a matter of time before stage three crossed over to stage four and end users began to ask that data stored in mainframe files be transferred to their microcomputer disks. This was a cumbersome process and required custom programming by IS personnel to build a special file for the end users' needs. Once the bulk file was transferred to the microcomputer, programs had to be written to make the data fit the microcomputer software formats. As inconvenient and time consuming as this file transfer was, it was still more efficient than rekeying data into the microcomputer disks from computer printouts.

- Stage five brought an onslaught of products under the title of micro-to-mainframe links. There are now literally hundreds of such products on the market. New ones are being announced almost every week, and the old ones (over a year old) are being enhanced. The vendors of both mainframe software and microcomputer software are facing the challenge of building bridges between the micros and the mainframes that will allow interactive sharing of the two resources. The biggest problem facing these two types of vendors is hurdling the incompatible data formats. The personal computer application software vendors have developed their products around unique formats, as have the mainframe applications and data base software vendors. Most of the major mainframe software vendors have developed and are marketing links that provide access to and reformatting of data stored in their

INPUT

proprietary products' formats for transfer and use in many of the most popular microcomputer application software formats. Unfortunately, the vast array of applications in production at any one data center makes a single micro-to-mainframe solution impossible.
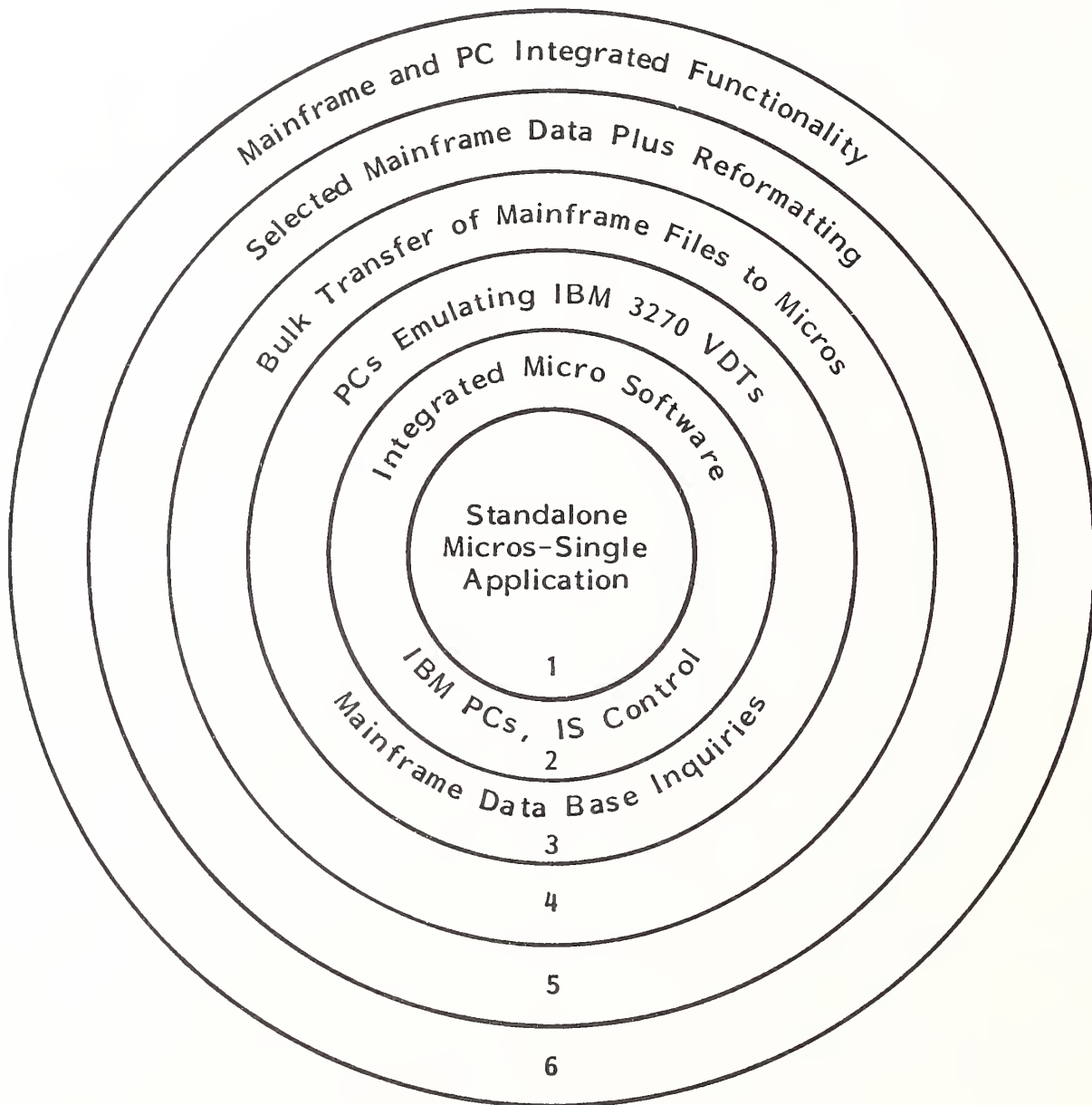
- As depicted by Exhibit III-I, INPUT believes stage six of microcomputer usage in business will be represented by a true integration of the micro and mainframe to provide the most effective solution to future information systems problems. The microcomputer will become an extension of the mainframe and will perform many of the front-end and back-end tasks of operational production systems heretofore handled by the mainframe. There may be file servers or departmental processors between the micros and the mainframes, but future systems architecture will take advantage of the microcomputer capabilities. Management Science America, Inc. (MSA) has just recently announced its newest category of micro-mainframe software, Distributed PC Applications, which will offload some of the normal mainframe data processing tasks onto the microcomputer. Until now, micro-mainframe link activity has placed an additional burden on the mainframe capacity because the many individual requests for data has been unanticipated and unrelated to production processing. If much of the data collection and information analysis processing can be transferred to the microcomputer, communications costs and requirements for mainframe power could be reduced.

2. THE EMERGING M-M APPLICATIONS

● The most common micro-mainframe applications today are financial modeling and statistical analysis. Electronic spreadsheets like Lotus 1-2-3, VisiCalc, and SuperCalc have gained much acceptance in corporate computing as effective tools for knowledge workers to perform information analysis. The spreadsheet offers end users a fast, interactive environment that can be modified quickly to suit their computing needs.

INPUT

EXHIBIT III-1

EVOLUTIONARY STAGES OF MICROCOMPUTER USAGE IN BUSINESS

Mainframe and PC Integrated Functionality

Selected Mainframe Data Plus Reformatting

Bulk Transfer of Mainframe Files to Micros

PCs Emulating IBM 3270 VDTs

Integrated Micro Software

Standalone
Micros–Single
Application

1

IBM PCs, IS Control

2

Mainframe Data Base Inquiries

3

4

5

6

- Before micro-mainframe solutions became available, end users were keying data into spreadsheet templates from data found in IS-generated reports containing corporate central or departmental data. End users have been seeking micro-mainframe connections to the source of this data to avoid the tedious rekeying task.

- Current end users of micro-mainframe applications are primarily the same as users of electronic spreadsheets: business analysts, accountants, and line managers. It is these people who have demanded access to corporate data for their analysis applications.

- INPUT expects future applications software offered by vendors to incorporate links with microcomputers. Microcomputers will be used more and more for front-end processing such as data entry, editing, and verification. In addition, interactive query and decision support analysis will also reside on micro-computers, while the data storage and maintenance and heavy data processing will remain on the mainframe.

- Also in the future, electronic mail and word processing applications will become prevalent micro-mainframe applications. Using the virtual disk access method, host computers will act as file servers and central depositories for distributed office systems applications.

- The micro-mainframe applications software market is in its infancy. Most of the current product offerings are of the terminal emulation or file transfer variety. Major software vendors plan to release new products with more functionality during 1985. These products will be the record transfer or distributed applications types of software. Mainframe applications software vendors will continue to provide micro-mainframe connections into their mainframe-based products.

INPUT

- Some of these products will give end users control over data access in a completely interactive environment; others will give IS control over end-user access via batch processing of end-user requests. In general, interactive applications software and relational data base management software vendors have extended end-user control to the microcomputer links that they offer, while systems software vendors (other than relational data base management software vendors) allow job execution control to remain with IS.

- Currently, few vendors have sophisticated micro-mainframe packages. Of those who do, Cullinet offers its Information Center Management System (ICMS), designed to allow end users two-way access to production data bases via its Information Data Base (IDB) product. The link directly accesses relational tables created on IDMS/R (the latest release of IDMS) and VSAM files. (See product profile in Chapter V for more information.)

- Other vendors will be announcing software products with equal capabilities as well as software with improvements in the end-user interface. Some of these improvements will include:

    - Multitasking background processing on the micro.

    - Memory resident "pop-up" menus that run underneath other applications packages, such as Lotus 1-2-3.

    - LAN gateway software allowing microcomputer-serviced LANs to share data with mainframes.

3. THE HIERARCHICAL INFORMATION NEEDS

- Today's competitive business organization demands more specialized information handling needs. Minicomputers have been used for departmental processing that offloads centralized mainframe processing. Personal computers are now beginning the step toward this same type of information

INPUT

processing distribution. The information handling needs of an organization are composed of three distinct components:

- Corporate integration.

- Departmental processing.

- Personal computing.

- Until recently, IS has concentrated its energies on centralized corporate processing and has allowed personal computing to be driven by the end user. Personal computing and departmental processing should operate as components complementary to, yet distinct from, corporate processing.

  - Personal computing involves processing for individual decision making and record keeping. File sizes are small and the information contained in them range from very specific (e.g., sales "tickler" file) to very general (e.g., regional sales data). The data is used by only one person a majority of the time, but needs to be shared with other end users within the same department or in different departments.

  - Departmental processing involves processing for departmental decision making and record keeping. File sizes are generally much larger than personal computing files but are smaller than corporate processing files. The files are used by groups of people rather than only one person, and the department has a more homogenous information need than the corporation as a whole.

  - Corporate integration, primarily integrated applications, involves processing for the company as a whole. Current and historical information is maintained for financial consolidation, auditing, and tracking of the entire organization as a business enterprise. As the central depository of all corporate information, communication links need to

- 27 -

INPUT

exist between corporate and departmental and corporate and personal computing systems.

- Micro-mainframe applications can be analysis, operational, or transactional, and involve a few, several, or many end users, depending on the type of application. Exhibit III-2 summarizes these considerations.

  - Research and analysis applications usually involve the professional end users from finance and marketing performing strategic information analysis. Strategic analysis involves forecasting and trend analysis, which requires summary historical data from a variety of production transaction data bases and files.

  - Operational applications involves the operational line managers who need to monitor the organization's day-to-day activities through performance measurement information. These end users may need to perform tactical analyses on this information to identify potential problems with operations. Tactical analysis involves ad hoc query and ratio testing, where the same tests are performed on a variety of different data combinations.

  - Production transaction applications may involve the bulk of the work force that needs to perform operational tasks, such as data entry, editing, and verification.

- The type of link required for each of these situations varies according to whether the end user is doing strategic analysis, tactical analysis, or transaction processing.

  - Research and analysis applications require a file transfer capability to download a specific data file for an analysis application or "model." Research and analysis applications can have relatively simple solutions because they satisfy unique needs of only a few end users. This kind of

- 28 -

INPUT

EXHIBIT III-2

- 29 -

MICRO-MAINFRAME LINK REQUIREMENTS

APPLICATION TYPE		REQUIRED LINK FUNCTIONS
	Many	
● Production Transaction Processing		● Bidirectional Data Movement in Diverse Environment
● Operational Performance Measurement	Number of End Users Involved	● Host Data Base Field Selection with Record Downloading
● Research, Analysis, Forecasting	Few	● File Transfer, (Custom Interface)

INPUT
USMM
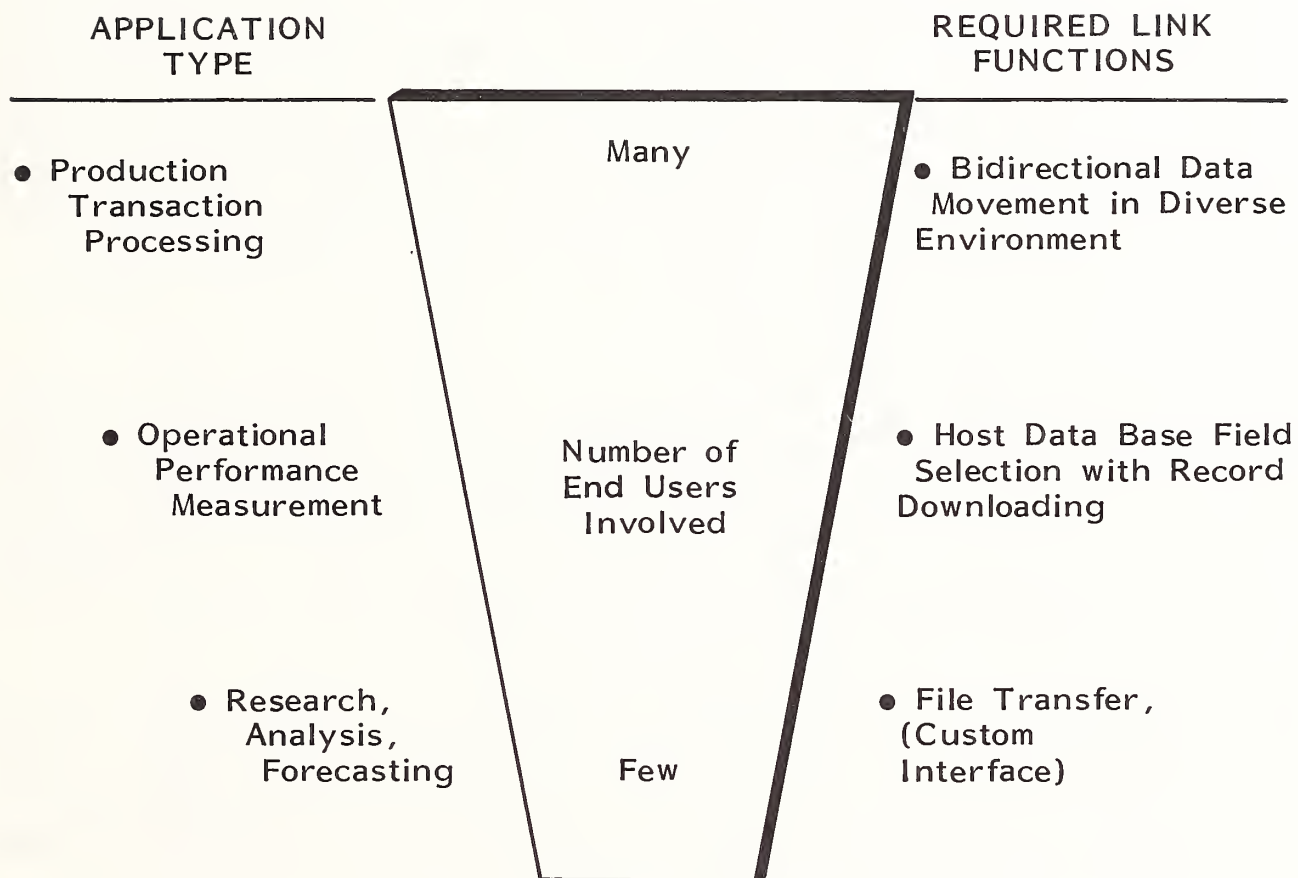
application usually involves processing historical data or data that doesn't change frequently. A custom, one-time data extraction program can be written in-house, and then the extracted data can be transferred using inexpensive file transfer software.

- Operational applications need more flexibility and access to a central library of data bases. End users for this type of application need mainframe field and record selection capabilities for downloading of data to the micro. Operational processing applications require giving several end users ad hoc query and reporting capabilities. These applications can be quite expensive, sometimes running in the hundreds of thousands of dollars just for the software. Additional costs can be incurred in developing data dictionaries and user security profiles.

- Production transaction processing requires the most sophisticated link, allowing bidirectional data movement in a diverse environment, which could include micro-mini-mainframe and micro-LAN-mainframe. Production transaction processing applications require heavy IS involvement and top-down systems design.

- Micro-mainframe is the beginning of a new trend toward applications software architecture aimed at satisfying the hierarchical information needs of organizations. IS should not ignore this hierarchical relationship when designing future applications systems.

4. DATA SECURITY AND INTEGRITY

- Record transfer and distributed application software offers security features, but file transfer and terminal emulation software usually does not (see Chapter IV). The security features that some M-M software vendors offer are:

- 30 -

INPUT

-   File-, record-, and field-level access capabilities giving end users read-
    (and sometimes write-) access to particular files, records, or data
    fields. Furthermore, field value access lets the end user access records
    for specified field value ranges; for example, "Records for employees
    with salaries less than $40,000."

-   End user session-monitoring features providing audit trails for IS to
    track data requests and data base usage.

-   Access security is installed via access codes assigned to file and field names
    stored in a user profile. After a request for data is made by the end user, the
    user profile is referenced by the software to verify access.

-   The ability to alter mainframe data bases and files from a microcomputer can
    be controlled by IS in the same manner as terminal users are controlled. The
    systems design phase will determine if it is desirable to have updating trans-
    actions collected or generated by a microcomputer.

-   A major security concern of IS is end-user access to confidential corporate
    data. Security software by itself cannot completely maintain data confiden-
    tiality. This is because once the end user prints a hard copy of the data or
    stores the data on a floppy diskette, the data is no longer under the software's
    security controls. Therefore, after end users have received the data on their
    micros, the problem of maintaining confidentiality rests with each end user.

    -   The best security solution in micro-mainframe applications is to make
        end users aware that data they possess is confidential and that they
        have a duty to maintain that confidentiality.

    -   The same security precautions afforded paper copies of corporate data
        need to be applied to personal computer data, including:

        .   Physical lock-up.

        .   Trade secret notification.

- 31 -

INPUT

B. GENERAL M-M PRODUCT CATEGORIES

- The majority of products marketed as "micro-mainframe links" provide only rudimentary terminal emulation and file transfer, frequently leaving the data formating, report file creation, and micro end-user interface up to IS to develop.

- Software in the micro-mainframe environment falls into four general categories. Exhibit III-3 summarizes the features of these four categories; below are more detailed definitions.

1. TERMINAL EMULATION

- Terminal emulation software typically allows a microcomputer to emulate a TTY, 327X, or VT100 logical device. With terminal emulation, the end user can access mainframe software applications such as decision support or fourth generation languages and can access host data through terminal inquiry facilities.

2. FILE TRANSFER

- File transfer software allows the end user to transfer an entire file selectivley (download subject to memory or disk space restrictions), and handles the primitive file conversion necessary for such a transfer between two different operating systems. This type of software typically includes terminal emulation as a functional component.

3. RECORD TRANSFER

- Record transfer software allows for data base-specific field and record selection. Frequently, record transfer software also offers file format conversion between micro and mainframe data base files that makes the

©1985 by INPUT. Reproduction Prohibited.

INPUT

EXHIBIT III-3

MICRO-TO-MAINFRAME SOFTWARE EVOLUTION

- ● Terminal Emulation Software

  - Mainframe Software and Data Access (DSS, FGL)

  - No File Transfer Capability

- ● File Transfer Software

  - Terminal Emulation

  - Operating System-Specific File Selection

  - Primitive File Conversion (e.g., MVS ←→ PCDOS ←→ TRSDOS ←→ VMS)

- ● Record Transfer Software

  - File Transfer

  - Data Base Specific Field and Record Selection

  - File Format Conversion (e.g., DIF ←→ VSAM ←→ WKS)

- ● Distributed Microcomputer Application Software

  - Field and Record Level Transfer

  - Automated Processes

  - Production Application Integration

transferred file readable directly into applications at either end of the connection. Although the connection with this type of software operates as a logical terminal unit, the end user usually is not made aware of this emulation. This software type either comes with a data extraction utility or interfaces to a specific data management package's extraction utility.

4.   DISTRIBUTED MICROCOMPUTER APPLICATIONS

- Distributed microcomputer applications refers to offloading portions of host product transaction-driven systems to the microcomputer. These applications go beyond those functions associated with decision support and are directed at the operational functions of the business. The linkage software becomes integrated with the applications software and is transparent to the end user. M-M software to be used in distributed microcomputer applications must have the same capabilities as the record transfer M-M products with bidirectional downloading and uploading features. IS will either have to acquire applications packages (general ledger, order entry, manufacturing, etc.) that include the micro linkage software or build applications around available record transfer M-M products.

- Some linkage software products use a virtual disk access method (VDAM) as the medium of file exchange. Connected via terminal emulation, VDAM allows microcomputer users to access a host system disk drive transparently as a micro disk. VDAM partitions VSAM files on the host into PC DOS format. This allows connected end users to share the same storage media without a local area network.

C.   LINKAGE COST CONSIDERATIONS

- IS user respondents were asked "how common" they thought micro-mainframe applications developed "solely in-house," "solely by the vendor," or "jointly in-

- 34 -

house and with the vendor" would be. Respondents felt that most of the applications development would be IS's responsibility and that applications would more commonly be developed solely in-house and with the vendor than solely by the vendor.

- This response reflects the fact that, like most applications, micro-mainframe applications require a high degree of customization to satisfy a particular organization's needs. For the most part, complete software solutions with minimal customization will only be available to members of the largest homogeneous industry sectors such as commercial banking or insurance, where vendors can easily profit from repeat software sales and minimum maintenance.

- However, there are some system software packages available from vendors that offer modular solutions. Vendors typically offer the basic communications component of micro-mainframe applications which can be used by any user organization.

- These modules range from simple terminal emulation packages to complete distributed applications (see Chapter V for product profiles). The cost of such solutions to micro-mainframe applications development are just as wide-ranging.

- Determining cost and weighing other considerations when deciding whether to purchase a packaged software solution or to develop a micro-mainframe link in-house (or choosing some combination of the two) will be discussed below.

I.   DIRECT COST

- Where vendor software is at least one component of the micro-mainframe solution, the direct costs involved in developing micro-mainframe applications include license fees, modification fees, and service contracts for the purchased component, and development and support staff expenses for the in-house components.

- 35 -

INPUT

- License fees can be quite expensive. Since the communication link typically requires software to reside on multiple micros, the cost per micro can add up to tens of thousands of dollars. For example, to connect 100 PCs using Informatic's Answer/DB would cost $95,000 for a perpetual license ($45,000 for the mainframe component, $50,000 for 100 PC components.)

- Vendor fees for modifications to accommodate special requirements of a particular installation and service contracts for maintaining this systems software can add to the license fees.

- Applications development may require special expertise in communications and data base management. This is especially true in an active distributed data base application, where a control program must keep track of each data base component.

- A special IS data management staff that understands not just the technical aspects of the system, but the business data relationships inherent in the application, is also necessary in order to maintain the integrity of the data.

- Another major direct cost that is often overlooked when considering M-M software is the need for additional hardware on both ends of the connection.

  - Each IBM PC that requires a link will need either an asynchronous RS-232C communications port or a synchronous coaxial adapter (typically 327X-type). Both options take up an expansion slot on the PC and cost hundreds of dollars per PC; these "boards" can run as high as $600 per PC. Some other types of microcomputers (e.g., Apple) come with an RS-232C port from the manufacturer.

INPUT

- If RS-232C ports are used, then modems are required for each micro-computer.

- On the host side, additional controllers, concentrators, or modems may also be required to handle the physical connection of additional end users who were not formerly connected.

2.   INDIRECT COST

- In addition to the direct costs associated with micro-mainframe applications development, several indirect costs need to be considered.

- The amount of data being transmitted in a linked end-user session with the host is generally much greater than a typical terminal connection, so performance degradation on the mainframe may result unless the frequency of data transmission is strictly controlled. Such degradation could result in the need for more processing power (e.g., another mainframe, more controllers, etc.).

- As with other types of purchased software, some features that are needed by a particular installation but lacking in the package will have to be included in the source code by IS. This will incur additional cost in development time and will later require maintenance. These modifications may also later invalidate vendor maintenance agreements.

- Indirect costs result when time being spent on micro-mainframe applications development could be spent on other applications.

- Exhibit III-4 summarizes the direct and indirect cost considerations.

INPUT

EXHIBIT III-4

MICRO-TO-MAINFRAME COST CONSIDERATIONS

- Direct/Fixed Costs

    - License Fees

    - Maintenance Fees

    - Vendor Modifications

    - Communications Hardware

- Indirect/Variable Costs

    - Applications Development Opportunity

    - Additional Communications Traffic

    - Additional Host Processing

    - Additional Host Disk Space

INPU
USMM

D. M-M STANDARDS ISSUES

- There are no specific standards established for products being marketed under the general classification of micro-mainframe links. Information exchange between different personal computer software packages and between personal computer packages and host hardware/software are the M-M functions that require standards.

- As discussed earlier in this chapter, the second stage of personal computer usage in business saw the beginning of integrated micro software packages that shared common data formats and user interfaces. Once the personal computers became linked to the IBM mainframe, there was the problem of translating the bit-code character set protocols, since personal computers use the ASCII character set and IBM mainframes use EBCDIC. The bit-code set translation has not posed any major problems because the M-M link products provide features to handle this.

- The two areas of M-M links that have needed standards are network information interchange and data format interchange. The standards that have emerged to handle these two areas are DIF from Software Arts, Inc. and DIA/DCA from IBM.

I. DATA INTERCHANGE FORMAT (DIF)

- DIF is a concept of organizing data in a common format to facilitate the sharing of data between two or more applications programs. The concept was conceived and developed by Robert M. Frankston, President of Software Arts, primarily for data exchange between VisiCalc and other personal computer applications. DIF is not a product that can be purchased. Personal computer software vendors have used the DIF protocol for moving data among applications from different vendors (e.g., VisiCalc to Lotus 1-2-3 to dBase II) for several years. The developers of M-M link products recognized the advan-

- 39 -

INPUT

tages of using a standard for data interchange, the greatest of these being the ability to allow interchange with a wide variety of personal computer applications. DIF has been accepted as a de facto standard format for data interchange (de facto because no organized standards group has sanctioned it).

- Some of the current micro-mainframe link products that support the DIF format are:

    - Attachment/370 edition from IBM.

    - ICMS from Cullinet.

    - ExpertLink from MSA.

    - pcMainframe from Oxford Software.

    - SmartLink from Software International Corp.

2. IBM'S INFORMATION INTERCHANGE STANDARDS

- IBM has established a set of protocols, collectively called DIA/DCA for Document Interchange Architecture/Document Content Architecture, to define a high-level standard for communications among IBM's office automation systems.

- The communications pieces of IBM's set of protocols include SNA and the Distribution Services (SNADS) for network control and Document Interchange Architecture (DIA) for protocols and data structures being transmitted among diversified nodes. DIA provides for three types of document interchange functions:

    - Library Services allows end users to store and retrieve documents from a central library.

- 40 -

INPUT

- Distributed Services allows users to send documents or other files to one or more locations on the same network.

- Application Processing Services allows end users to invoke document transformation routines and execute programs on the host mainframe.

- IBM's Document Content Architecture (DCA) supports the DIA functions in the SNA environment by defining the format of the data, text, images, graphics, or voice being transmitted.

- Advanced Program to Program Communications (APPC) is an enhancement to SNA that provides the following features required to support IBM's plans to integrate office automation, personal computing, and data processing:

  - Standard application interfaces to the network.

  - Peer-to-peer communications between workstations and mainframe.

  - Compatible protocols between all types of workstations.

- APPC introduces two new vital units to SNA: LU 6.2 and PU 2.1. The logical unit, LU 6.2, supports communications between distributed application programs and has a common interface with applications across the entire SNA network. The peer-to-peer communication is provided through the new physical unit, PU 2.1, which also supports multiple physical data links to interconnect workstations.

- The IBM Distributed Office Support System (DISOSS) is a software package that allows interchange of DCA documents among IBM 8100/DOSF, Display-writer, Scanmaster 1, 5520, System/36, and Personal Computers using a host 370-type (370, 4300, 30XX) system running under OS/VS2 (MVS) or VSE, and CICS/VS. Micro-mainframe software vendors have not conformed to DCA

INPUT

format. Furthermore, many microcomputer software vendors have never heard of DIA or DCA.

- To take full advantage of DISOSS, IS will either have to replace PC word processing software with DIA/DCA-compatible software, write a conversion utility (that reformats, say, Wordstar documents to DCA) to use with current micro-mainframe software, or wait for vendors to provide such software.

- 42 -

INPUT

IV M-M APPLICATIONS DEVELOPMENT CASES

IV   M-M APPLICATIONS DEVELOPMENT CASES

- Micro-mainframe applications development is going on today in leading-edge companies in information management. Most of these applications come from companies operating in information-intensive industries (such as banking and finance or insurance). The M-M applications themselves, however, are simple implementations that satisfy end-user information needs and harness the processing power of microcomputers.

- With an over 40% share of the micro-mainframe applications software market, the virtual disk access method stands out as the quickest and simplest way to set the stage for most current M-M applications. More advanced M-M applications are only beginning to appear (as is the software to facilitate their implementation), and their development is being driven by IS systems designers who have learned how the PC operates.

- Described below are several M-M applications that have been developed by three user organizations: a bank, an insurance company, and an electrical insulation and plastics manufacturer.

A.   THE BANK

- A major bank which INPUT interviewed has two micro-mainframe applications. The first is a commercial loan application on the IBM PC using Lotus

INPUT

1-2-3 and a TempusLink (Micro Tempus) virtual disk. The second is a customer account information application using dBase Answer (Informatics) to connect a dBase II IBM PC client data base with a mainframe accounts information data base.

- The first application is a Lotus 1-2-3 model for commercial loan credit analysis. Six end users required access to mass storage for nearly 300 megabytes of 123 files. The bank initially considered purchasing two small minicomputers (NCR Towers) as file servers to network the six PC's. This solution would have cost the company approximately $90,000. The final solution, however, used an IBM mainframe as the file and disk server to the PCs, and cost less than $10,000.

  - Users are charged back for disk storage as are other terminal users. Host system backups keep the end users from losing valuable information. The end users can share data easily and access a single source for the Lotus 1-2-3 files without the need for an expensive local area network.

  - Although this solution was simple to implement, some potential problems did exist. The first problem was mainframe disk drive capacity. A new mainframe disk drive lease was being negotiated that offered additional capacity for the same monthly cost. The Tempus-Link application then costs the company roughly the same as a 3380 drive.

  - The second problem was system degradation caused by the PCs' frequency of data transmission. To avoid degradation problems, the six PCs were spread across three controllers, with no more than two PCs connected to any one controller. IS chose a cautious approach and did not experiment with a greater number of connections.

INPUT

- The second micro-mainframe application is a customer information data base used to prepare marketing department personnel for client interviews. This application required access to mainframe real-time production data bases. The bank had narrowed down their linkage product choices to Answer Series and OmniLink (OnLine Software International), based solely on the capabilities of each.

    - Before setting a financial advisory appointment with a client, the financial analyst extracts the customer's account information from a mainframe IMS data base and merges it with a micro-based dBase II data base that keeps track of personal information on the customer, such as income and net worth. Prior to the micro-mainframe connection, the end users were rekeying the mainframe data into the dBase applications.

    - The bank used Informatics' Answer Series because they already had Answer/DB, an on-line query system, installed. IBM PCs were also already in place with IRMA boards for terminal emulation. Because the data dictionaries were already defined for Answer/DB, implementing the dBase II connection was a simple matter of installing the PC Micro Answer connection software.

- Answer Series was selected over OmniLink for two reasons:

    - OmniLink did not support the IMS operating environment at the time it was being considered.

    - Answer/DB was already installed for interactive applications.

- The bank cost-justified the Answer System on the basis of the man-time saved by eliminating rekeying of host-based data. One man-year of time allocated over four years justified the $30,000 purchase for the Micro Answer module to Answer/DB. Time to install was less than half of a day for IS.

INPUT

- INPUT recommends taking the following steps in the process of selecting software to use for the latter micro-mainframe implementation:

    - Define the end users' requirements for data from the mainframe data base. How much? How often? The bank discovered that a significant amount of rekeying was occurring, enough to justify a linkage solution.

    - Identify the available software products based on functionality desired.

    - Narrow the choices down to two products (the bank selected OmniLink and Answer Series).

    - Weigh the interface-ability of the packages with existing mainframe software.

B.   THE INSURANCE COMPANY

- The insurance company is centralized with 80 field offices supporting roughly 3,500 agents. Each field office is connected to the home office via a Micom asynchronous protocol converter. Each controller allows up to 8 IBM Personal Computers to be connected either directly via asynchronous serial ports or through dial-up with modems. The company has come 1,500-plus micro-computers companywide; 150 of these are connected to the IBM 3081 running under CICS in an MVS/XA environment.

- The company uses a TempusLink (Micro Tempus) virtual disk for distributing notices, PC software enhancements, and other files from the host to end users. In addition, it has several internally developed microcomputer programs that handle insurance industry-specific applications, such as a universal life policy system and a proposal system.

- 46 -

- The company's IBM PCs are configured as 327X/PCs (in the home office) or IBM 3101 dumb terminals (in the field offices). The software for 3101 terminal emulation was developed in-house by IS in Assembler (with some parts in BASIC) and has subroutines for downloading files from the virtual disk for specific applications. The virtual disk also transfers files between host applications and the virtual disk via TempusLink's Import and Export utilities.

- The company began with Wang Model 2200T microcomputers in 1977 and experimented with several other microcomputer brands (e.g., Apple and HP) before standardizing on the IBM PC in 1982.

  - On the Wangs, a proposal development application was developed externally in BASIC which required rate information located on the home office's mainframe computer to be transferred to the micros on an annual basis. No link was needed then because Wang provided the service of transferring the mainframe-based data to the Wang microcomputer.

  - When IBM PCs replaced the Wang microcomputers, the proposal system was rewritten. The rate information had to be downloaded from the host to the PCs, and the company decided to purchase TempusLink. Using the Import utility of Tempus Data, a five megabyte rate information dataset was transferred to the virtual disk, then downloaded to a PC.

  - The dataset is subdivided at the microcomputer (using a BASIC program) into 14 files for distribution to users of particular applications. Any one of these 14 data subsets can then be either mailed on floppy diskettes to sites running the proposal development system or transferred to other PCs connected to the virtual disk.

INPUT

- Eventually, other uses of TempusLink evolved and were implemented on an ad hoc basis. Today, the company has some 30 application systems running on the IBM PC.

    - One of these other systems is a univeral life policy application that requires interest rate data to be transferred to several PCs from a mainframe data base once or twice a month.

    - This transfer uses a screen capture subroutine of the 3101 terminal emulation software which the company developed. A CICS transaction reads the host data base and sends the data to the PC in one and two kilobyte segments.

- Microcomputer users at the company are supported in three different ways:

    - A company-run computer store is a value-added distributor for IBM and sells PCs to employees.

    - A company-run service department gives PC users maintenance support.

    - Four end-user support departments specialize, respectively, in Personal Computer programming and system development for pension systems, communications and research, and two separate life insurance products.

C.   THE MANUFACTURER

- This electrical insulation and plastics manufacturer has an IBM 3083 and a Burroughs 7800 located at its home office in California. These two main-frames are connected with other IBM 3083s and IBM 4300s in offices in

- 48 -

Belgium, Germany, the U.K., and France. Financial and other applications are centralized in the California office.

- Every office has a TempusLink virtual disk system, and some 75 to 100 IBM PCs connected either by IRMA boards where there are controllers nearby or dial up access using modems. The manufacturer has a company-wide total of some 200 to 250 PCs.

  - Files are transferred between mainframes with an internally developed Transaction Delivery System (TDS).

  - A module was added to the TDS to allow it to read TempusLink virtual disk files and translate them into IDMS files on the IBM systems and DMS2 files on the Burroughs system.

- Financial data collection and performance reporting applications use the virtual disk as a staging bin for uploads and downloads. Applications on the PC for key-to-disk operations were written in COBOL.

- Initially, the company was not clear on what TempusLink would be used for, but it felt that the virtual disk concept would interface well into any micro-mainframe implementation.

  - Training of end users and maintenance is ongoing.

  - Problems occur most frequently during micro-mainframe systems development when the microcomputer system is done independently of the mainframe system.

- The manufacturer believes that data entry at the site of origination reduces mail costs. But most importantly, this micro-mainframe application saves valuable time by correcting errors at the site of origin and eliminating delays caused by the mail.

- 49 -

D. PREREQUISITES TO M-M APPLICATIONS DEVELOPMENT

- Companies leading the edge in information management are prepared for M-M applications because they have taken steps along the way to satisfy end-user computing. Many of the steps were characterized by the following:

  - In all of the cases studied, micro-mainframe applications evolved over a period of time.

  - Top-down systems design was rarely used, and was considered only necessary for the more sophisticated applications.

  - The first implementations usually took advantage of existing systems and software, some of which served the data extraction or data communication needs of applications.

  - End-user services (like an information center) or interactive processing capabilities were well established.

  - At least one microcomputer specialist was either on the IS staff or retained on a consulting basis.

- 50 -

INPU

V MICRO-MAINFRAME SOFTWARE PRODUCTS

V MICRO-MAINFRAME SOFTWARE PRODUCTS

- Chapter III discussed four types of micro-mainframe software products:

    - Terminal emulation.

    - File transfer.

    - Record transfer.

    - Distributed application.

- Terminal emulation software makes a microcomputer appear as a terminal device to a host system. No file exchange can be performed, but some terminal emulators allow screen data transfers.

- Many vendors offer terminal emulation products. The majority of terminal emulation software sold, however, is sold by vendors of microcomputer communications components. Some of these vendors and their hardware products are:

    - Digital Communications Associates: synchronous coaxial adapter and protocol convertors.

    - Hayes Microcomputer Products: internal and external asynchrounous modems.

- 51 -

INPUT

- Forte: synchronous coaxial adapter and protocol convertors.

- The following product profiles are provided to give the reader an understanding of file transfer, record transfer, and distributed applications' capabilities.

  - File transfer and record transfer products differ in where control over data extraction is placed. The two steps to data extraction are task definition and extraction execution. Task definition involves using the computer to select the fields, records, and other data items that are to be extracted from the host data bases and transferred to the micro. Extraction execution involves commanding the host computer to begin the job of extracting the selected data items from the host data bases. Control over this activity can reside with IS staff or (in an interactive environment) with the end users. Exhibit V-I shows whether control over task definition and/or extraction resides with IS or the end user for each of the products profiled.

  - Distributed applications incorporate the features of record transfer and have the micro perform an application function (e.g., data entry) as well.

A.   FILE TRANSFER

I.   BLAST

- Vendor: Communications Research Group, Baton Rouge, LA.

- Cost: Software is $250-$5,500 per CPU; Blast Box protocol convertor is $695.

INPU

EXHIBIT V-1

M-M DATA EXTRACTION CONTROL

PRODUCT	REQUEST/TASK DEFINITION RESPONSIBILITY	EXECUTION TIME RESPONSIBILITY
Blast	IS	IS
TempusLink	IS	IS
pcMainframe	IS	EU
Answer	EU	IS
ICMS	EU	IS
Smart Link	EU	EU
Expert Link	EU	EU

IS = Information Systems

EU = End Users

INPUT
USMM

- Blast software and hardware enables dissimilar computers to perform file transfer via serial asynchronous communications ports. Blast is currently available for over 110 different computers (micro, mini, and mainframes) and supports more than 23 different operating systems.

- For IBM MVS/TSO and VM/CMS users, both Blast software and hardware are required. The software performs the file server functions and the hardware component is the Blast Box, an RS-232 asynchronous line adapter that converts the half-duplex, 7-bit output from the host program to the full-duplex, 8-bit output Blast protocol. The Blast file transfers can be executed by microcompter users in terminal emulation mode. Blast Box is needed only where half-duplex, 7-bit asynchronous communications needs to be converted to Blast's full-duplex, 8-bit asynchronous communication.

- Some of the major features of Blast under MVS/TSO and VM/CMS are:

  - Compatibility with all other micro, mini, and mainframe Blast implementations.

  - Files can be transmitted in both directions simultaneously.

  - Transmitted files can be text or binary.

- Blast doesn't allow selection and extraction of specific data stored in data bases or files, but assumes the files to be downloaded have been previously assembled. Blast could be used in conjunction with an already existing fourth generation language or a similar report generation facility that can create extract files for downloading or uploading. Blast should be considered for applications where diverse systems need to exchange data files.

2. TEMPUSLINK

- Vendor: Micro Tempus, Montreal, Quebec (Canada).

INPU

- Cost: TempusLink software is $6,200-$7,000, depending on the installation. The cost for TempusData software has not yet been determined because it is a new product, expected to be released later in 1985. In addition, each PC must be equipped with a 327X protocol convertor (e.g., IRMA or Forte board, or 3270/PC), which adds $500-$800 to the PC cost.

- TempusLink (version 3.1) uses the virtual disk access method (VDAM) as a medium for file transfers. File transfer can be accomplished using the Import/Export utilities, Host Applications Program Interface (HAPI), or Applications Program Interface (API).

    - The virtual disk access method establishes a link with the host computer by making a host computer's disk drive appear to the micro-computer as its own disk drive unit. To the host, the microcomputer appears as a terminal. Files that reside on the virtual disk are in PC DOS format and can be "COPYed" to and from other PC disk drives using the PC DOS COPY command.

    - Mainframe-based VSAM files can be transferred to the virtual disk using TempusLink's file Import utility. PC DOS text files can be transferred to the host using the file Export utility.

- Security features offered by TempusLink are limited to password-protected virtual disks.

- The major advantage of TempusLink is that it provides a centralized environment for micro-mainframe applications. The virtual disk can be used as a staging area for extract files to be transferred to and from the end user. TempusLink allows several end users to share data and program files without the use of a local area network. This can be a useful capability where many users may need access to the same data extract.

INPUT

- TempusLink does not have record extraction capabilities. Like other file transfer micro-mainframe products, files to be transferred must be generated on a custom basis.

- Another disadvantages of TempusLink is the speed and frequency with which files themselves are downloaded. Large file transfers using TempusLink can bog down a communications controller and disrupt other terminal operations. Also, end users are frequently used to dumping large amounts of data from memory to their local disk drives (e.g., spreadsheet save). This sort of activity could also degrade performance.

B.   RECORD TRANSFER

1.   PCMAINFRAME

- Vendor: Oxford Software Corporation, Hasbrouck Heights, NJ.

- Cost: Software is $9,000 for IBM DOS installations and $12,000 for OS installations. Price includes eight IBM PC licenses, with each additional PC license priced at $300.

- PcMainframe allows records and fields to be selected from mainframe VSAM files and downloaded to the IBM PC. PcMainframe comes with host and PC software components. The host component works much like a report generator. Data extraction requests (called "profiles") are created by IS staff (data base administrators) and end users execute these requests from their PC. Some of the outstanding features of pcMainframe are:

  - Parameters can be specified in the profile definition. The end user is prompted for the parameter values when the request is executed.

INPUT

-    Transmitted data can be automatically converted to DIF, BASIC (comma delimited), and other fixed length ASC II file formats that IS defines in a profile.

-    A central library can also be defined for exchanging files among PCs.

• PcMainframe provides flexibility to IS in the creation of profile definitions. Through profiles, data extraction needs can be managed by IS for each end user. Profiles can be defined that select records based on field value ranges. Output format (position, layout, and picture) can be strictly controlled.

• A disadvantage of pcMainframe is that IS must define all end-user requests. IS can become bogged down with many different requests. This problem may be compounded by the fact that multiple VSAM files cannot be accessed from a single profile. The library facility is more cumbersome to use than a virtual disk system because file transfers among PCs sharing the Library must also be defined in profile by IS.

• PcMainframe can provide a quick solution to simple data extraction needs from VSAM files. The cost of the program may not be justified where only a few end users require custom interfaces or where multiple VSAM files need to be accessed to satisfy end-user requests. The system might be a good choice, however, where several end users require custom interfaces to individual VSAM files.

2.   ANSWER SERIES

• Vendor: Informatics General Corporation, Canoga Park, CA.

• Cost: The mainframe extraction component, Answer/DG, is $30,000 for the IBM DOS version and $45,000 for OS version. Each PC component costs $500. In addition, each PC must be equipped with a 327X protocol convertor (e.g., IRMA or Forte board, or 3270/PC), which adds $500-$800 to the PC cost.

- 57 -

- The Answer Series includes Answer/DB and one of four microcomputer packages (Lotus Answer, VisiAnswer, dBase Answer, or MicroAnswer). The Answer Series extracts and converts IMS/DL/I, VSAM, ISAM, and General Data Base Interface (GDBI) data into formats readable directly by VisiCorp, Lotus Development, and Ashton Tate software products.

- The GDBI format allows data access to TOTAL, ADABAS, IDMS, and other data base management systems that offer GDBI conversion of their contents. MicroAnswer is an OEM product which supports microcomputer software vendor development of Answer/DB links with their products.

- Answer/DB is an on-line reporting system. Installation of Answer/DB requires that IS define an Answer/DB On-Line Library that acts as a central data dictionary for multiple data bases. The PC companion products provide off-line request definition, data capture, and file format conversion of Answer/DB requests.

- End users create data extraction requests on their personal computers using the menu-driven PC component of their choice (Lotus Answer, VisiAnswer, etc.). The end user creates an extraction request (called a "task") by selecting fields from an IS-defined data glossary displayed on the PC screen. Ranges, breaks, and summary statistics can be specified for each field.

- The task, once defined, is submitted to the Answer/DB "task processor" as a batch job. End-user tasks are placed in a job execution queue that may be processed by the "task processor" continually (i.e., psuedo-interactively), at specified time intervals, or sporadically.

  - When the task processor executes, all end-user tasks are merged into one batch so that the host data base is passed only once in the process.

- 58 -

INPUT

- Each user's task is separated and placed in a disk output bin on the mainframe. The end user can later retrieve task output by requesting task retrieval at his PC, and the data is transmitted down to the PC.

- The task processor, unlike other record transfer software products available, performs data format conversion upon execution.

- User security profiles control access, defined by IS, to data bases at the file, record, field, and field content level.

- Some of the advantages of the Informatics approach are:

    - Control of execution time remains with IS because of batch orientation.

    - Once end-user security profiles and data base glossaries are established, end users control their own extraction requests without further IS involvement. As end users gain familiarity with the host data bases, less IS expertise is required.

    - The Answer Series offers an easy-to-use end-user interface as well as a manageable environment for effective data distribution.

    - The menu-driven, pick-and-choose interface can eliminate the need for training in a structured query language.

- Some of the disadvantages of the Informatics Answer are:

    - If users' requests are frequent, performance degradation could be significant because extractions are executed against the production data bases when the task processor is activated.

INPUT

- Data uploading from microcomputers to production files cannot be performed by Answer/DB because it is an extension of an on-line system.

● The Informatics Answer is suitable for providing support for operational-type applications, where end users perform tactical analysis of day-to-day operations. The easy-to-use end-user interface can relieve IS of custom report writing and serve as an information center-type application without the need for a relational data base management system.

3. INFORMATION CENTER MANAGEMENT SYSTEM (ICMS)

● Vendor: Cullinet Software, Inc., Westwood, MA.

● Cost: A prerequisite software package for ICMS is Cullinet's IDMS/R relational data base management system. IDMS/R currently sells for $75,000. The complement products that comprise ICMS cost $75,000. The IBM PC software component (Symphony Link or Universal Link) costs an additional $300 per copy. In addition, each PC must be equipped with a 327X protocol convertor (e.g., IRMA or Forte board, or 3270/PC), which adds $500-$800 to the PC cost.

● ICMS is a relational data base management system, complete with query and report generation facilities. The link accesses relational tables created on IDMS/R, the latest release of IDMS. In order to create these relational tables, IS must define a central data dictionary used to extract data from non-IDMS/R mainframe production data bases. ICMS has three components:

- Information Data Base (IDB). This piece of linkage software resides on the host and allows direct access to IDMS/R and VSAM files through special dictionaries. Using a conversion utility, IDB also allows retrieval of data from other data bases, such as IBM's IMS.

- 60 -

-   End-User Computing Facility. This software resides on the mainframe and consists of application productivity tools, including Cullinet's Automatic System Facility (ASF) which aids the end user in building an application. The End-User Computing Facility also includes the On-Line Query (OLQ) language which enables end users to display ad hoc and production reports.

-   Open Systems Architecture. This is a significant component for the integration of office automation, personal computing, and data processing for those organizations that use Data General, DEC, or Wang minicomputers. Each of these companies has signed agreements with Cullinet. Users of their departmental systems can transparently access mainframe data through the IDB. Data General has already announced the availability of its IDB link software. Announcements are expected from DEC and Wang.

- Both microcomputer components are menu driven and reside concurrently with other applications packages (for example, Lotus 1-2-3) on the PC.

-   Universal Link resides on the microcomputer as an operating environment above PC DOS. This environment is referred to as the "Information Manager Tool" of Universal Link. Universal Link converts an IDB end-user data extract into Lotus 1-2-3 WKS format with a single command. The Information Manager is also used with Cullinet's GoldenGate product.

-   Symphony Link functions differently than Universal Link. Rather than being an environment above PC DOS, Symphony Link works like an additional menu under Lotus' Symphony. Symphony Link is an add-on product for Lotus Development Corporation's Symphony integrated microcomputer software. By interfacing with IDB, Symphony Link converts IDB end-user data bases into Symphony's special data format on the PC. Lotus develops these add-on products in-house, so that it

- 61 -

©1985 by INPUT. Reproduction Prohibited.

INPUT

- can protect its source code and ensure that these add-on products conform to Lotus' standards.

- Cullinet Software is an industry leader in mainframe data base products and recently began offering applications software for manufacturing, banking and finance, and human resource information management. IDMS/R, a relational data base management system, is the most current revision of Cullinet's IDMS network data base management system and is not a product apart from IDMS. There are approximately 1,400 installations of IDMS/R in existence.

- ICMS provides a sophisticated solution to micro-mainframe applications development and end-user computing. For organizations with several diverse and unconnected data bases, the installation of ICMS could be a formidable undertaking. For the organization that has already matured toward central-ized systems, integrated data bases, end-user computing, and interactive processing, ICMS would follow nicely.

- But for most organizations, ICMS is a consideration further down the road. The cost, data base conversion, new applications development, and applica-tions modification effort necessary to make ICMS an effective tool for infor-mation management make it overkill for satisfying simpler end-user data base access demands.

C.   DISTRIBUTED APPLICATIONS

- Distributed applications will usually need to be developed by IS. IS must modify existing mainframe applications, write the micro segment of the application, then use one or a combination of file transfer or record transfer products to provide the connection to the microcomputers.

INPU

- Distributed applications are offered by vendors who target the larger industry sectors (such as commercial banking and insurance). They offer specific applications software packages that integrate with their mainframe- or mini-based interactive applications. Examples of such vendors follow:

I.   SMARTLINK

- Vendor: Software International Corp., Andover, MA.

- Cost: As an optional module including mainframe and micro software, Smart-Link sells for $2,995 per unit.

- SmartLink works with Software International's General Ledger system. SmartLink resides on the microcomputer and emulates a 327X interactive query to a General Ledger application file.

- Data is transferred to the microcomputer in ASCII format and converted to DIF or Lotus 1-2-3 (WKS or PRN) file formats. Data items can be directed to particular cells of a Lotus 1-2-3 spreadsheet.

- A menu-driven system allows the user to define request files (called "maps"). These maps are then "submitted" to the General Ledger system and interpreted as an interactive request, giving end users control over when data is extracted. Data uploading applications work similarly, except updating is queued in batches for IS to execute.

- As an application-specific product, SmartLink offers an end-user interface that is familiar to users of Software International's General Ledger (GL). However, SmartLink is limited because only GL data can be accessed.

2.   EXPERTLINK

- Vendor: Management Science America, Atlanta, GA.

INPUT

- Cost: Both the host and PC components of ExpertLink are provided at a per PC cost of $1,000. Hardware required with each PC is either a 327X protocol convertor (e.g., IRMA or Forte board, or 3270/PC) or a serial communications card and a Hayes 1200, 1200B, 2400 modem. Either of these can add $500-$800 to the per PC cost. The former connects to an IBM 3705 or 3725 communications controller. The latter connects to an IBM 3101 protocol convertor with an asynchronous port or dial up modem.

- ExpertLink was first released in 1982. MSA claims that over 700 units have been installed in approximately 350 companies.

- ExpertLink by itself is file transfer software for the IBM PC, but when used in conjunction with Management Science America's (MSA) Data Base Sharing module of its mainframe applications software products, it becomes field transfer software. In addition, when ExpertLink is used with PC Data Entry, the link becomes a distributed application.

    - Data Base Sharing is an on-line data base query and report generation facility. Data Base Sharing currently only accesses data bases created by MSA's applications software. A future product, Information Expert, will allow access to other data bases as well. Information Expert is expected to be released in late 1985.

    - PC Data Entry is software for the IBM PC which allows off-line data entry for MSA accounting software products. Error checking and data conversion information is downloaded from the host application to the PC at the beginning of a PC Data Entry session. The PC collects data off-line, then transfers the data stored on the PC to the mainframe application via ExpertLink. In addition to PC Data Entry, MSA plans to release other applications linkages that offload host processing by connecting with ExpertLink.

- 64 -

INPUT

- On the PC, ExpertLink can convert transferred data to several microcomputer data formats automatically, including:

    - Lotus 1-2-3 (WKS).

    - VisiCalc (VC).

    - SuperCalc (CAL).

    - Data Interchange Format (DIF).

    - Lotus print file format (PRN).

- The advantages of ExpertLink are:

    - Command files can be stored on the PC, allowing end users to transfer data from host MSA applications.

    - Distributed applications will continue to be developed by MSA for integrating PCs with mainframe-based MSA applications (e.g., PC Data Entry).

    - Different levels of capability can be purchased separately, allowing easy evolution across the four types of micro-mainframe software from terminal emulation through distributed applications.

    - MSA's experience with applications integration should mature as it releases more Distributed PC Applications.

- Some of the disadvantages of ExpertLink are:

    - Currently, only MSA applications files can be accessed. However, Information Expert will allow ExpertLink to reach other applications' data bases later.

- 65 -

INPUT

-        Control over data transmission request creation and scheduling is given
        to the end user. This may strain controller and host performance.

- ExpertLink and its compatible components (e.g., PC Data Entry, Data Base
  Sharing, etc.) are ideally suited for MSA clients. However, Information
  Expert should draw attention from non-MSA clients as a tool for integrating
  microcomputers into the corporate strategy because of its proposed flexibility
  in handling different data bases and integration with ExpertLink.

D.   SUMMARY

- Exhibit V-2 shows a summary of the profiled M-M software characteristics.
  Shown in the exhibit are:

  -        Where data extraction task definition and execution control reside.

  -        The cost for the micro component and host component.

  -        The type of software.

- Micro-Mainframe applications are moving toward more integration and flexi-
  bility. IS can use file transfer or record transfer products in developing
  distributed applications. For organizations that lack centralization of data
  and require custom interfacing with end users, the virtual disk access method
  should be especially useful. For more advanced organizations with integrated
  data bases, the more advanced record transfer products should be considered.

INPUT

EXHIBIT V-2

M-M SOFTWARE CHARACTERISTICS

| PRODUCT NAME | EXTRACT CONTROL | | COST | | M-M SOFTWARE TYPE |
	TASK	RUN	PC	MAINFRAME	
Blast	IS	IS	$ 250	$495–$5,500	File Transfer
TempusLink	IS	IS	Included	$6,200–$7,000	File Transfer
pcMainframe	IS	EU	$ 300	$9,000–$12,000	Record Transfer
Answer	EU	IS	$ 500	$45,000	Record Transfer
ICMS	EU	IS	$ 300	$75,000–$150,000	Record Transfer
SmartLink	EU	EU	$2,995	Included	Distributed Application
ExpertLink	EU	EU	$3,000	Included	Distributed Application

IS = Information Services

EU = End Users

INPUT
USMM

VI CONCLUSIONS AND RECOMMENDATIONS

VI CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

- End users are demanding access to corporate data. This demand is not new, but now users want the data delivered electronically, in a timely fashion, and in a format they can easily use on their micros.

- End users are primarily using this data with financial, planning, and analysis micro applications (i.e., spreadsheets). Thus, most of the end users' needs are satisfied with the timely downloading of selected corporate data that is compatible with their micro software. Alternatively, users' needs may be satisfied by providing direct micro access to mainframe data and by using mainframe software to perform their analysis.

- Vendors response to this demand is a potpourri of products called micro-mainframe links. These range from simple terminal emulation to distributed applications which extract specific mainframe data, transmit it to the micro in the format compatible with a specific micro product, and even provide application functionality on the micro. The cost of these products ranges from under $100 to over $500 per user, with the mainframe software portion of the link costing from $10,000 to $150,000.

- IS response to micro-mainframe demand is cautious. There is a fear of end users breaching the security and controls that protect corporate data. There

- 69 -

INPUT

is also a concern that IS resources must be used for extracting and transmitting data. Another factor is the added micro user support inherent in the need for mainframe access.

- The varied population of micro users wanting mainframe access portends management problems.

    - Which data bases should be accessed?

    - Which users should be given priority?

    - Who will assure that corporate security and control procedures are followed?

- Micro-mainframe demand has surfaced as a major corporate issue, with the emphasis on how to efficiently disseminate computer-based information throughout the organization.

    - This is a strategic issue. It must be addressed from the corporate perspective and will require significant resources to plan and implement.

    - Although this is a long term issue, the immediate needs cannot be ignored. Micro-mainframe applications are an interim solution to the data distribution problem. The current array of products are tools, not solutions. If properly managed, however, they can provide benefit to both end users and the organization.

INPUT

B.   RECOMMENDATIONS

- Micro-mainframe applications must be part of the corporate information systems strategy. IS must develop a corporate computing strategy that defines the role of end-user computing in general and of microcomputers in particular.

    - IS must identify the support levels it provides to M-M applications.

    - IS should work with corporate management to establish security and control procedures for corporate data. Data that is distributed to end user computers are the end users' responsibility. They must adhere to these procedures and must be held accountable for the security of the data under their control.

- IS must make an appraisal of the current maturity of the company's micro-computer usage. In Chapter III, INPUT categorized six stages of micro-computer usage. Compare your company's usage to these stages. Do not acquire micro-mainframe products that are inconsistent with your company's usage.

- Identify the end users' true needs versus their perceived ones. Work with users to help them determine:

    - What information is needed?

    - How timely should this be?

    - What format is best?

©1985 by INPUT. Reproduction Prohibited.   **INPUT**

- IS should then determine:

    - Sources of information.

    - Use of information.

    - Means of providing the information.

    - Other users of the information.

- Only after true user needs are identified and sources and uses are determined can an educated appraisal of micro-mainframe products be made.

    - Remember, the ultimate solution of the information need of the user may not be a micro-mainframe application. In fact, for the corporation as a whole, M-M applications are only a component of the solution.

    - If implementing a corporate information strategy is more than three years away, look for an interim solution.

        . Build a product that focuses on short-term needs at minimum cost.

        . These solutions will usually center on file transfer products. IS must closely schedule extracts of key corporate data and download them to micro users. Users of the same information need to be grouped and must adhere to the same timing requirement.

    - Determine end user's information needs. Grouping similar user needs together is an integral part of developing the corporate information strategy.

- 72 -

INPUT

- More advanced micro-mainframe products (record transfer and distributed applications) require mainframe software that costs from $10,000 to $150,000; to be economically justifiable, a critical mass of users must be found. These products also require an in-depth understanding of user needs and a production attitude toward M-M applications.

  - Micro-mainframe applications are treated as a scheduled production application. Data processing operations must treat the uploading and downloading of information as another scheduled job.

  - IS must support both the mainframe and micro portions of the applications.

  - Auditable procedures must be in place in both the data center and end user facility to assure corporate data security is maintained.

  - Unless the hardware, software, communications, and human resources are committed for these applications, they will provide little benefit and will not justify their substantial expense.

- Don't fit the application to a product. Many vendors promise their products have extensive functionality; in many cases, there is more functionality (and expense) than is warranted by the needs of the user. It is easier to add users and micro applications to try to justify an expensive product. Unless these added users needs have been researched and incorporated into the information strategy, adding them to the product's user base could be a costly error. Micro-mainframe applications require corporate planning. Keep user needs in perspective.

INPUT

- Micro-mainframe applications are tools, not solutions. They are a means of disseminating information. M-M applications require extensive IS involvement to be successfully implemented. Their benefit lies in showing corporate management and end users the potential for using computer-based data to improve the productivity and profitability of the organization.

    - How information is disseminated is a long term question that needs to be addressed from the corporate perspective.

    - M-M linkage provides the means to begin distributing information to the people who need it.

    - Keep M-M applications in perspective. Don't underestimate the resources required to implement and maintain them and don't over-estimate the benefit they will provide. The corporate benefit of information can only be achieved by establishing an information management strategy. IS must be the architect of this strategy. M-M applications are prototypes of future information delivery systems. Used properly, they can demonstrate to management the importance of establishing this strategy and of IS's role in implementing it.

INPUT

APPENDIX A: USER QUESTIONNAIRE

APPENDIX: USER QUESTIONNAIRE

MICRO-TO-MAINFRAME USER QUESTIONNAIRE

1. With 1 representing "disagreement" and 5 representing "agreement," to what extent do you agree that "within five years most applications that are now host-based will have a considerable amount of functionality taken over by personal computers that are linked to the host."? _____

    Why? _____

    _____

    _____

2a. INPUT is defining "on-line batch" micro-to-mainframe linkages as those linkages where the micro performs processing on a standalone basis and where periodically the micro and the host exchange data. The host may then further process the data received.

2b. Given this definition, do you believe that links between host computers and micros will be predominately interactive, predominately on-line batch, or about the same?

    ☐ Predominately Interactive

    ☐ Predominately On-Line Batch

    ☐ About the Same

    Why? _____

    _____

3a. With 1 representing "extreme centralization" and 5 representing "extreme decentralization," how would you rate your information systems function? _____

3b. With 1 representing "no impact" and 5 representing "great impact," how would you rate the impact of micro-to-mainframe applications on moving a company like yours toward a more decentralized information systems function? _____

    Why? _____

    _____

    _____

INPUT

4a. With 1 representing "no assistance' and 5 representing "much assistance," how much assistance do you expect to be able to get from vendors in helping to plan and implement your organization's critical micro-to-mainframe applications? _____

4b. More specifically, how would you rate:

IBM _____

Microcomputer hardware vendors _____

Software vendors who primarily offer mainframe software _____

Software vendors who primarily offer micro software _____

Remote processing (timesharing) vendors (e.g., McAuto, Boeing) _____

Turnkey systems vendors _____

Professional services and consulting firms _____

Next, I am going to describe several approaches for constructing micro-to-mainframe applications and I would like you to rate each on a 1-to-5 scale, with 1 representing "not common" and 5 representing "very common."

INPUT

5. The first approach I would like you to rate concerns . . .

    a . . . modifications of existing applications systems.

        1. How common do you think modifications of this type done solely by the vendor will be?_____

        2. How common do you think modifications of this type done solely by in-house information systems staff will be? _____

        3. How common do you think modifications of this type done jointly by vendors and in-house information staff will be? _____

    b . . . writing new applications that use existing files and data base(s)?

        1. How common do you think modifications of this type done solely by the vendor will be? _____

        2. How common do you think modifications of this type done solely by in-house information systems staff will be? _____

        3. How common do you think modifications of this type done jointly by vendors and in-house information systems staff will be? _____

Finally, I would like you to rate the approach that concerns . . .

    c . . . writing new applications that use new files and data base(s):

        1. How common do you think modifications of this type done solely by the vendor will be?_____

        2. How common do you think modifications of this type done solely by in-house information systems staff will be?_____

        3. How common do you think modifications of this type done jointly by vendors and in-house information systems staff will be?_____

INPUT

6a. For your own organization, what specific applications do you see as being the most suitable as micro-to-mainframe applications? (They need not be computerized applications now.) (Use work space below.)

6b. Are these applications planned, and if so, at what stage are you implementing them? (Planning stages: no concrete plans, planning, applications being developed, applications already implemented.)

6c. Do you expect to develop these applications in-house, purchase an existing package from an outside vendor, or modify an existing package in-house?

Application Name	Stage				Source		
	None	Plan	Devl.	Impl.	Inhouse	Vendor	Both
1. _____	____	____	____	____	____	____	____
2. _____	____	____	____	____	____	____	____
3. _____	____	____	____	____	____	____	____
4. _____	____	____	____	____	____	____	____
5. _____	____	____	____	____	____	____	____

COMMENTS:

1. _____

2. _____

3. _____

4. _____

5. _____

INPUT

7a. In order of importance, with 1 being the most important, what do you consider to be the three problems solved or alleviated by micro-to-mainframe systems?

1. _____

2. _____

3. _____

7b. In order of importance, with 1 being the most important, what do you consider to be the top three problems caused by micro-to-mainframe systems?

1. _____

2. _____

3. _____

7c. What can your organization do to solve each of these problems?

1. _____

2. _____

3. _____

7d. What can vendors do to solve each of these problems?

1. _____

2. _____

3. _____

INPUT

8. On a 1-to-5 scale, with 1 representing "low importance" and 5 representing "high importance," how important will it be for . . .

a . . . your company's micros to be connected with mainframes within your company? _____ . Why this rating? _____

_____

What type of communications linkage would you most likely use for this situation? _____ Local Area Network _____ Leased Lines _____WATS

_____Dial-Up _____Public Data Network ____Other:_____

b . . . the same micro to link to more than one brand of mainframe at different times? _____ Why this rating? _____

_____

What type of communications linkage would you most likely use for this situation?

_____ Local Area Network _____ Leased Lines _____WATS

_____ Dial-Up _____Public Data Network _____ Other:_____

How important will it be for . . .

c . . . your company's micros to be connected with micros in other departments? _____ . Why this rating? _____

_____

What type of communications linkage would you most likely use for this situation?

_____ Local Area Network _____ Leased Lines _____ WATS

_____ Dial-Up _____ Public Data Network _____ Other:_____

d . . . your company's micros to be connected with mainframes in other companies? (e.g., subsidiaries, suppliers, or customers) _____ .

Why this rating? _____

_____

INPUT

What type of communications linkage would you most likely use for this situation?

_____ Local Area Network _____ Leased Lines _____ WATS

_____ Dial-Up _____ Public Data Network _____ Other:_____

e. How important will it be for your company's mainframe to be connected with micros outside of your company? _____. Why this rating? _____

_____

What type of communications linkage would you most likely use for this situation?

_____ Local Area Network _____ Leased Lines _____ WATS

_____ Dial-Up _____ Public Data Network _____ Other:_____

9a. What telecommunications operating system(s) do you have?

_____ TSO _____ CMS _____ CICS _____ IMS DC Others:_____

_____

9b. Which of these will require micro links by 1987?

_____ TSO _____ CMS _____ CICS _____ IMS DC Others:_____

_____

10a. What data base management systems do you have?

_____ IMS _____ IDMS _____ ADABAS _____ Total Others:_____

_____

10b. Which of these will require micro links by 1987?

_____ IMS _____ IDMS _____ ADABAS _____ Total Others:_____

_____

INPUT

11a. Do you expect microcomputer use in your company to accelerate the use of mainframe-based relational data base management systems in your company?

_____ Yes _____ No (if No, skip to next number)

11b. Which one(s)? _____ DB2 _____ MDSS III _____ Basis Others:_____

_____

12a. Do you expect microcomputer use in your company to_____ increase _____ have no effect on _____ , decrease your mainframe processing requirement by 1987?

As a percentage of your current mainframe processing capacity, what percentage change do you expect in mainframe processing demand to result from microcomputer use by 1987? _____%

12b. Do you expect microcomputer use in your company to _____ increase, _____ have no effect on _____ decrease your mainframe disk storage requirement by 1987?

As a percentage of your current mainframe disk storage capacity, what percentage change do you expect in mainframe disk storage demand to result from microcomputer use by 1987? _____%

INPUT

(For number 13, 13a should equal the sum of 13b, 13c and 13d)

	Number Installed Now	Number by 1987
13a. How many micros do you have total in your company now? How many by 1987?	_____	_____
13b. How many of these are used as standalone units now? How many by 1987?	_____	_____
1. How many local area networks do you have now? How many by 1987?	_____	_____
2. How many of these LANs have communication links to a mainframe or mini-computer now? How many by 1987?	_____	_____
13c. How many of your micros are used in local area net-works now? How many by 1987?	_____	_____
13d. Excluding those micros used in LANs, how many of your micros are connected to a mainframe or minicomputer now? How many by 1987?	_____	_____

14. Of all your micros which are connected to the mainframe, about what percent are used solely for terminal emulation now? _____% And in 1987? _____%

15. Of all your micros, about what percent are in use by computer professionals versus end users?

IS Professionals _____% + End Users _____% = 100%

16a. Do you have any multiuser microcomputer systems? _____Yes _____No (Use work space below.) (If No, ask for 1987.)

16b. How many multiuser microcomputer systems (e.g., AT, Altos) do you now have installed? _____ How many do you expect to have installed by 1987? _____

16c. How many multiuser microcomputer systems have communications links to a mainframe or minicomputer? _____ How many do you expect will have links by 1987? _____.

INPUT

17. On a 1-to-5 scale with 1 representing "low importance" and 5 representing "high importance," how important do you see UNIX-based systems as being to your organization's plans? _____ Why? _____

_____

_____

THANK YOU!!!

INTERVIEWER: (Rate the interviewee's disposition as a source for additional information on the topic of micro-to-mainframe.)

_____ Very Informative

_____ Informative

_____ Not Very Informative

INPUT

APPENDIX B: USER RESPONDENT SAMPLE
DEMOGRAPHICS

APPENDIX B: USER RESPONDENT
SAMPLE DEMOGRAPHICS

- 85 -

SIZE IN REVENUES	RESPONDENTS
Less than $250	42
$250	31
Greater than $1 Billion	42
Unknown	14
Total	129

INDUSTRY	RESPONDENTS
Discrete Manufacturing	9
Process Manufacturing	15
Transportation	7
Medical	4
Services	8
Utilities	3
Banking	28
Distribution	16
Insurance	4
Federal Government	7
State and Local Government	23
Other	5
Total	129

INPUT
USMM

APPENDIX C: VENDOR RESPONDENTS INTERVIEWED

APPENDIX C: VENDOR RESPONDENTS INTERVIEWED

- Ashton Tate
- AST Research
- Communications Research Group
- Cullinet Software, Inc.
- Data General Corporation
- Digital Communications Associated
- Digital Equipment Corporation
- Informatics General Corporation
- Information Builders
- International Business Machines
- Lotus Development Corporation
- Management Decision Systems
- Management Science of America, Inc.
- Mathematica
- Micro Tempus Inc.
- On-Line Software International
- Oxford Software Corporation
- Software AG of North America
- Software International Corporation
- VM Personal Computing

INPUT
USMM